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Middle meningeal artery with multiple pseudoaneurysms and their management

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ABSTRACT

Pseudoaneurysms of the middle meningeal artery (MMA) are a rare pathology. Here we present a case of a patient with a non-surgical traumatic subdural hemorrhage, whom was found to have three unruptured aneurysmal lesions along the middle meningeal artery. The patient underwent successful endovascular embolization of his MMA and its aneurysmal lesions. This case presents a unique morphology of a rare disease treated safely and effectively using endovascular embolization.

1. Introduction

MMA aneurysms and pseudoaneurysms are known but rare entities which have been reported in the past in multiple case reports [1–4]. Pseudoaneurysms typically result from traumatic injuries to the MMA [2,3,5]. The natural progression of pseudoaneurysms, regardless of location in the body, is concerning for eventual rupture [6]. MMA pseudoaneurysms are unique in that the natural history is not very well elucidated due to the rarity in occurrence. Because of this, it is unclear how aggressively they should be treated once they have been diagnosed. This pathology has been known to cause life threatening hemorrhage, with potential for recalcitrant epileptiform activity, but can also resolve spontaneously [2,7,8–11]. This makes the management of these lesions perplexing when they are detected incidentally.

1.1 Case.

Our case is a 68 year old male with a history of alcohol abuse who presented to the emergency room three days after a mechanical fall with head trauma. A head CT without contrast was performed revealing bilateral non-surgical acute subdural hematomas with no significant midline shift. The patient was managed conservatively and a repeat head CT (Fig. 1A) progression of his right sided subdural hemorrhage with 4 mm right to left midline shift. Of note, no skull fractures were noted on either the initial or follow up head CT (Fig IB). This prompted him being set up for an elective middle meningeal artery (MMA) embolization to prevent further progression.

The patient underwent digital subtraction angiography (DSA) using a 6 French sheath via the right radial artery. Selective catheterization of the external carotid artery was performed. During the procedure it was noted that patient had three aneurysmal dilatations in succession along the proximal posterior (parietal) branch of right MMA (Fig. 2A and 2B). There was no evidence of extravasation or rupture from the three aneurysmal lesions.

After evaluating all branches of the right external carotid artery, the decision was made to include the three aneurysmal lesions along with the distal MMA in the embolization. The MMA underwent super selective catheterization with a microcatheter and the posterior branch of the MMA was embolized with n-butyl cyanoacrylate(n-BCA). Then an accessory meningeal branch suppling the frontal region was embolized. Care was taken to insure there were no anastomotic branches to the ophthalmic artery or vascular supply to the orbit. After injecting the embolic material, a vessel run was used to confirm successful embolization of the parietal branch of the MMA including and the aneurysmal lesions and the accessory meningeal branch (Fig. 3). Catheters were removed afterwards and hemostasis was achieved using a radial artery compression device. A routine follow up outpatient CT angiogram 2 weeks after the procedure revealed successful MMA and pseudoaneurysm occlusion with stable subdural hemorrhages.

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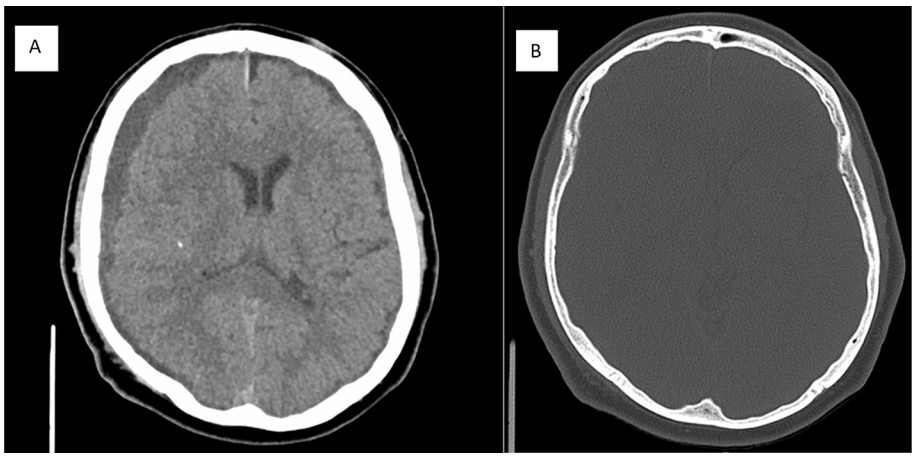

Fig. 1. Outpatient head CT from 2 week follow up. Fig. 1A is a non contrast axial head CT showing the subdural collections have become hypodense with the right sided hematoma exhibiting mass effect. Fig IB is the bone window from the same head CT which does not show evidence of a skull fracture.

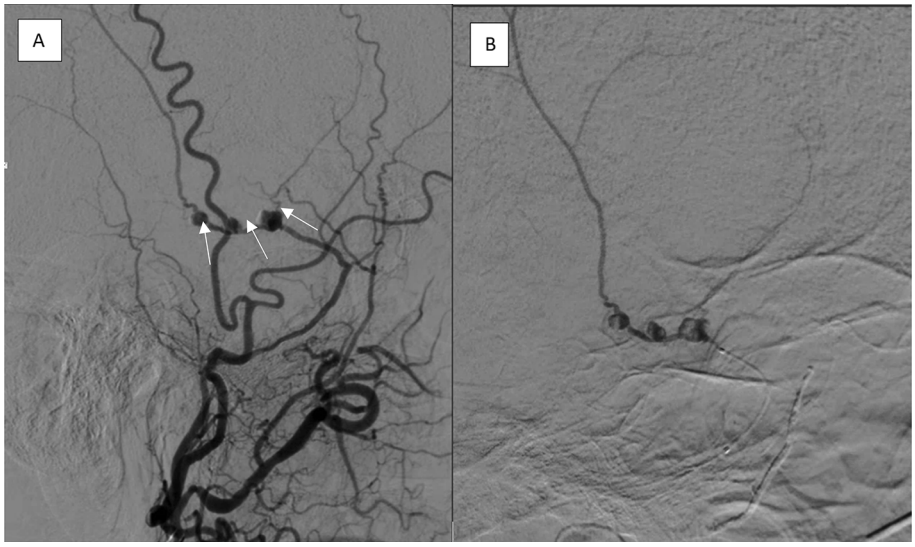

Fig. 2. Frames from the intervention of the right external carotid artery. Fig. 2A is an external carotid run demonstrating three consecutive aneurysmal lesions (arrows) on the middle meningeal artery. Fig. 2B shows super selective catheterization of the right middle meningeal artery where the intervention took place.

2. Discussion

Here we present a case where a patient was found to have three consecutive aneurysmal lesions along the proximal posterior branch of the MMA. Given the patient's history of alcohol abuse and multiple falls, we believe these lesions are traumatic in etiology and most likely represent pseudoaneurysms. Unfortunately, we do not have histology to confirm this and it is impossible to delineate the acuity of these aneurysm-like lesions on DSA, so we cannot comment on their natural history. Also, we are unable to elucidate if all three of these came from the same insult or if they resulted from isolated traumatic events. Our review of the literature shows that traumatic MMA pseudoaneurysms in isolation are a rare occurrence [3,12]. Finding multiple pseudoaneurysms is even more uncommon. One case report shows a patient with multiple nontraumatic MMA aneurysms with a concomitant vein of Galen malformation [1]. Presumably, these aneurysms developed secondarily to the altered hemodynamics in that reported case. Another article reported a patient with two distal traumatic MMA pseudoaneurysms located on different branches [9]. Posttraumatic pseudoaneurysms in other case reports were commonly associated with skull fractures unlike our patient who had no skull fractures [2,5,8,12]. Others reported an MMA pseudoaneurysm developing after a craniotomy to the skull, possibly due to direct damage to the MMA during surgery [13].

With the increase availability and use of CT angiograms of the head and the increasing popularity of MMA embolizations, we expect an increased detection of incidental vascular findings including MMA pseudoaneurysms. We have had a significant increase in volume of MMA embolization at our institution since we started performing the procedure in 2018. We have performed over 40 MMA embolizations in 2020 alone and this is the only case to demonstrate aneurysmal lesions along the MMA. There is a growing number of case reports showing that endovascular methods are safe and effective in treating these pseudoaneurysms [4,10,13,14]. When detected incidentally we recommend treating these pseudoaneurysms using endovascular techniques. Embolization options include liquid embolic agents such as n-BCA and Onyx® (ethylene vinyl alcohol copolymer, Medtronic) or simple coil embolization. In the case we presented, the pseudoaneurysms were an incidental finding and fortuitously along the same vessel planned for embolization in treatment of the chronic subdural hematoma. This allowed us to address both the subdural hematoma and the aneurysmal lesions simultaneously. While endovascular techniques are assumed to be safe in experienced hands, care should be taken to avoid complications like blindness and facial paralysis by avoiding dangerous

Fig. 3. A frame from the DSA of the right external carotid showing embolization of the right middle meningeal artery and its three aneurysms (arrow).

anastomoses and branches of the MMA. One of the anastomoses is with the ophthalmic artery, or in extreme situations, the presence of a meningo-ophthalmic artery as the primary source for blood supply to the orbit. Care should also be taken to detect and avoid embolization of the petrous branch of MMA supplying the geniculate ganglion of CN VII [15]. This can be achieved by embolizing the MMA distal to skull base as a petrous branch on the MMA is not always detected on the angiogram

3. Conclusion

Pseudoaneurysms of the MMA are rare lesions that are usually found incidentally and are associated with trauma. Our literature review shows that these lesions, although rare, can progress and can cause life threatening hemorrhage [2,7,8,10]. Endovascular embolization is a reasonable treatment option when treating incidental and non-symptomatic MMA pseudoaneurysm as the literature shows that it can be accomplished safely with good results.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] M. Akyuz, R. Tuncer, Multiple middle meningeal artery aneurysms associated with fistulous galenic arteriovenous malformation: A case report, Turkish Neurosurg. 20 (2010) 544–546.
[2] M. Bruneau, T. Gustin, K. Zekhnini, C. Gilliard, Traumatic false aneurysm of the middle meningeal artery causing an intracerebral hemorrhage: Case report and literature review, Surg. Neurol. 57 (3) (2002) 174–178.
[3] A. Gerosa, A. Fanti, B. Del Sette, A. Bianco, C. Cossandi, E. Crobeddu, S. Forgnone, R. Fornaro, G. Panzarasa, Posttraumatic middle meningeal artery pseudoaneurysm: Case report and review of the literature, World Neurosurgery 128 (2019) 225–229.
[4] W.S. Lesley, M.R. Thomas, S.I. Abdulrauf, N-butylcyanoacrylate embolization of a middle meningeal artery aneurysm in a patient with neurofibromatosis type 2, Am. J. Neuroradiol. 25 (2004) 1414.
[5] R.A. Roski, M. Owen, R.J. White, Y. Takaoka, E.M. Bellon, Middle meningeal artery trauma, Surg. Neurol. 17 (3) (1982) 200–203.
[6] B.G. Benoit, G. Wortzman, Traumatic cerebral aneurysms, J. Neurol. Neurosurg. Psychiatry 36 (1973) 127–138.
[7] C. Akyol, E. Turkoglu, B. Kazanci, H. Seckin, H. Kertmen, M. Bavbek, Intraparenchymal haematoma related to true middle meningeal artery aneurysm: A case report. BMJ Case Reports, 2009, bcr0320091711.
[8] D. Jussen, E. Wiener, P. Vajkoczy, P. Horn, Traumatic middle meningeal artery pseudoaneurysms, Neuroradiology 54 (10) (2012) 1133–1136.
[9] E. Kpelao, K.A. Beketi, K.M.H. Ahanogbe, A.K. Moumouni, A.K. Doleagbenou, K. Egu, B. Ntimon, M. Tchaou, P. Egbohou, Middle meningeal artery aneurysm: Case report, Surg. Neurol. Int. 8 (1) (2017) 172, https://doi.org/10.4103/sni.sni_159_17.
[10] D.-H. Lim, T.-S. Kim, S.-P. Joo, S.H. Kim, Intracerebral hematoma caused by ruptured traumatic pseudoaneurysm of the middle meningeal artery: A case report, J. Kor. Neurosurg. Soc. 42 (5) (2007) 416, https://doi.org/10.3340/jkns.2007.42.5.416.
[11] Q. Shah, J. Friedman, A. Mamourian, Spontaneous resolution of traumatic pseudoaneurysm of the middle meningeal artery, Am. J. Neuroradiol. 26 (2005) 2530.
[12] E. Montanari, G. Polonara, R. Montalti, M. Vivarelli, R.A. Ricciuti, R. Giorgetti, A. Tagliabracci, Delayed intracerebral hemorrhage after pseudoaneurysm of middle meningeal artery rupture: Case report, literature review, and forensic issues, World Neurosurgery 117 (2018) 394–410.
[13] M. Suzuki, S. Kominami, K. Koketsu, T. Mizunari, S. Kobayashi, A. Morita, Endovascular repair of a middle meningeal artery aneurysm after cranial surgery, NMC Case Report J. 2014, 1:6-8.
[14] N.K. Khattar, A.C. White, E.M. Fortuny, et al., Management of unruptured traumatic middle meningeal artery pseudoaneurysms through onyx embolization, Cureus 9 (2017), e1794.
[15] S. Geibprasert, S. Pongpech, D. Armstrong, T. Krings, Dangerous extracranial-intracranial anastomoses and supply to the cranial nerves: vessels the neurointerventionalist needs to know, AJNR Am. J. Neuroradiol. 30 (8) (2009) 1459–1468.